UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Escola Superior d'Enginyeries Industrial,
Aeroespacial i Audiovisual de Terrassa

BACHELOR THESIS

BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING

DESIGN AND CFD STUDY OF A DOUBLE V DIFFUSER

POLYTECHNIC UNIVERSITY OF CATALONIA

ESEIAAT

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BUDGET

Aerodynamics Department

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INTRODUCTION

This document will present the budget related to the realization of the project. The costs will be divided into direct and indirect.

JUSTIFICATION OF COST

Taking into account that the project has been carried out in its entirety through the use of the computer, it is understood that the direct costs will be higher than the indirect costs. This is because the bulk of the project involves a lot of engineering work.

Direct costs are a type of costs that are directly involved in the realization and production of the goods or services of a company, such as investigation, 3D design, memory writing, etc.

The project has been carried out by an Aerospace Vehicle Engineering student for 7 and a half months. The work period was from February 13, 2019 until September 30, 2019, working an average of 20 hours per week.

The hourly salary of a student with these characteristics is difficult to estimate, so the hourly salary of a junior engineer will be used for engineering cost calculations. This salary in 2018 was estimated at $12€/h$ [1].

DIRECT COST

Direct costs are a type of costs that are directly involved in the realization and production of the goods or services of a company.

Direct cost include:

- **Theory study and investigation**: During the realization of the project, many hours have been devoted to the study of fluid mechanics theory. Time has also been invested in research on the aerodynamic elements of Formula 1, CFD theory, etc.
- **CAD model generation**: For the simulation of 2D and 3D geometries it has been necessary to invest several hours in the creation of the models through the use of CatiaV5 and later processed in ANSYS SpaceClaim.
- **Simulation hours**: Most of the time project was dedicated to simulation in ANSYS Fluent after preparing and meshing all the designs. Learning to use the program properly, understanding the configuration used represented an important part of the time.
- **Data analysis**: After the simulation was completed, the results were compared and the data obtained was analyzed. Data were exported to the Microsoft Excel program for information processing and graphic creation.
- **Documents writing**: From the beginning of the project the documents began to be written.

The direct cost are shown in Table 1.

Concept	Price/hour [€]	Time [h]	Price [€]
Theory study and investigation	12	60	720
Subtotal		60	720
CAD model generation			
2D model	12	5	60
3D conventional design	12	20	240
3D double V design	12	20	240
Pre-processing	12	30	360
Subtotal		75	900
Simulation hours			
2D optimization	12	60	720
3D meshing	12	10	120
Conventional diffuser simulation	12	60	720
Double V diffuser simulation	12	100	1200
Subtotal		230	2760
Data analysis			
ANSYS Post-processing	12	30	360
Microsoft Excel	12	30	360
Subtotal		60	720
Documents writing			
Report	12	210	2520
Annex	12	5	60
Budget	12	8	96
Subtotal		223	2676
TOTAL		648	7776

Table 1: Direct cost

INDIRECT COST

Indirect costs are those that are not directly attributable to the production of a particular good or service.

Indirect cost include:

- **Software**: includes all the program and software license used during the study.
- **Energy resources**: It refers to the cost of the electricity consumed by the computer during the study. The average consumption of a laptop is between 20 and $100W/h$ [2]. An average value of $60W/h$ will be taken.

The indirect cost are shown in Table 2.

Concept	Description	Price/unit [€]	Units	Price [€]
CatiaV5 License	Annual Student	90	1	90
ANSYS License	Student License	Free	1	Free
Microsoft Office License	Office Home and Student	149	1	149
Overleaf PRO License	Student suscription	9	1	9
Energy resources	-	0.135	$60[W/h] \cdot 648[h] = 38.88[kW]$	5
TOTAL				253

Table 2: Indirect cost

TOTAL COST

Table 3 shows the total costs.

Type of cost	Total [€]
Direct cost	7776
Indirect cost	253
Total cost	8029

Table 3: Total cost

Bibliography

[1] Lorena Gonzalez. Como ser ingeniero aeroespacial. requisitos, sueldo y cursos., 2018. [Online, accessed September 15, 2019] https://cursos.com/ingeniero-aeroespacial/.

[2] Excite. Cuánta electricidad consume un ordenador portátil o de sobremesa al mes, 2015. [Online, accessed August, 20, 2019] http://finanzas.excite.es/cuanta-electricidad-consume-un-ordenador.html.